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(54) CONCRETES

(71) I, CHRISTIAN DUSSEL, a French citizen, of 11 Rue de l'Yser, 31000 Toulouse, France, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particluarly described in and by the following statement:—

This invention relates to building materials of the concrete type.

Besides conventional concretes formed from an agglomerate of stones, sand, hydraulic cement and water, pozzolana concrete is known, which is derived from the foregoing by replacing the stones with granules of pozzolana, which are relatively light volcanic cinders.

Plastic concretes are also known, in which mineral fillers are mixed with a binder constituted by an aqueous emulsion of a plastics material such as polyester resins. These resins, however are not entirely satisfactory since the addition of the mineral filler has the effect of breaking the emulsion to give a heterogeneous product. For this reason, it is possible to use only a certain proportion of certain special fillers and the concrete mix obtained is therefore expensive and is used only for certain applications such as ornamentation or certain bedding operations.

On the other hand, when concrete is employed in prefabrication of elements or units in moulds, for use in building, pozzolana concrete containing hydraulic cement has the disadvantage of requiring a setting time of 4 to 5 hours compared with the much shorter polymerisation times which may be obtained using plastic concrete.

An object of the present invention is to eliminate the above-mentioned disadvantages by producing a concrete mix which lends itself to the prefabrication of elements intended for building but which sets so that it can be extracted from its mould after much shorter periods than hitherto, and which, nevertheless, possesses properties entirely comparable with those of conventional materials at a cost scarcely higher and with a greater precision of moulding.

In accordance with the present invention a concrete mix comprises an agglomerate of at least one porous mineral filler in a binder which contains both a polyester resin emulsified with water and an hydraulic cement, the content of water and cement in the mix being such that at least part of the water in the emulsion is necessary to hydrate and harden the cement.

In a preferred embodiment of the invention the porous mineral filler consists of volcanic granules or cinders such as granules of pozzolana, and the hydraulic cement comprises alumina cement. The quantity of polyester resin should be just sufficient to ensure a first rapid setting of the concrete so that it can be removed from a mould after a relatively short time (about 15 minutes), and a complementary amount of the alumina cement then ensures that the concrete continues to harden utilising the water contained in the resin emulsion and possibly also water contained in the pores of the pozzolana granules particularly if the granules have previously been moistened with water.

One particular process for preparing a concrete mix embodying the invention will now be described.

The initial weight of pozzolana granules and the grain size are chosen according to the result desired. It is known, for example, that in order to obtain a very porous concrete, a grain size confined within a narrow range should be used. On the other hand, to obtain a denser concrete which is more resistant to compression, it is advantageous to mix coarse grains with fine grains and use the smallest possible amount of medium size grains. In order to produce a construction concrete which is both very strong and has a good coefficient of heat insulation, 50% of granules with a size of 2 to 3 mm and 50% of granules with a size of 3.5 to 4.5 mm are preferably used.

The selected amount of pozzolana granules is then moistened by immersion in water followed by draining. This filler is then placed in a mixer of the usual type and alumina cement is added in a proportion of 25% of the volume of pozzolana. This composition, which has a practically dry

appearance, is mixed for a minute and a half.

The emulsifiable polyester resin, for its part, is formed separately as a viscous liquid with a weight of resin which is 7% of the weight of the pozzolana, that is 70 g of resin per kilo of pozzolana. To this there is added the amount of water necessary for forming the emulsion, that is about 50% of the weight of resin, and then the emulsion of the water in the resin is produced by means of an emulsifying stirrer. To the emulsion obtained in this way there is added 2% by weight of catalyst and the mixture is stirred, and then 1% by weight of accelerator is added and the mixture is stirred again. In this way, a kind of cream of thin consistency is obtained and this cream is added to the powdery mixture of moistened pozzolana and alumina cement previously formed. Mixing of the whole is continued in the mixer for a further minute and a half until a homogeneous mixture is obtained.

The mixture prepared in this way is then drained on a grid to remove the excess water. Since the resin has coated the grains of pozzolana impregnated with alumina cement in the course of the mixing process, the water drained off is clear without entraining the slightest amount of ingredient.

The mortar drained in this way is then used for moulding the desired product by casting, injection or transfer, which product may range from a simple parpen to much larger prefabricated building elements or units. It is particularly advantageous to use a metal mould on a vibrating table in order to benefit from the greater precision of moulding permitted by this material.

After a relatively short time, about 15 minutes at room temperature, the moulded part has acquired sufficient solidity for it to be removed from the mould, by reason of the polymerisation of the polyester resin. The empty mould is thus available for the next moulding and fewer moulds are needed for a given throughput compared with the number required using conventional concretes containing only hydraulic cement. The parts removed from the moulds can be handled and stored easily. During the few hours that follow, the material continues to harden in consequence of the setting of the alumina cement utilising both the water remaining in the polyester emulsion and the water impregnating the pozzolana.

After a few hours, the moulded parts have practically speaking reached their final hardened state and can be employed directly for building. Alternatively, these parts may be stored if required without any risk of their properties being affected by subsequent temperature changes, since their hardening is very rapidly completed.

In the end, each kilo of pozzolana produces about 1.500 kilos of concrete which, once it is hardened, possesses a density of about 1.5 to 1.6 against the density of 2.6 to 2.7 for regular concretes. This is therefore a matter of a relatively light product with a low coefficient of heat conduction ($k=0.2$) and which at the same time permits the construction of walls with high sound insulation having a coefficient of attenuation of the order of 30 to 43 decibels.

Due to the small proportion of resin in its composition, the product obtained is less expensive than plastic concrete and at the same time possesses excellent fire resistance and general properties close to those of conventional concretes.

WHAT I CLAIM IS:—

1. A concrete mix comprising an agglomerate of at least one porous mineral filler in a binder which contains both a polyester resin emulsified with water and an hydraulic cement, the content of water and cement in the mix being such that at least part of the water in the emulsion is necessary to hydrate and harden the cement.

2. A concrete mix according to claim 1, in which the porous mineral filler consists of volcanic granules or cinders such as pozzolana granules.

3. A concrete mix according to claim 1 or claim 2, in which the hydraulic cement comprises alumina cement.

4. A concrete mix according to claim 3, in which the proportion of alumina cement relative to the proportion of mineral filler comprises substantially 25% by volume.

5. A concrete mix according to claim 2, in which the weight of resin in the emulsion comprises substantially 7% of the weight of the volcanic granules or cinders in the agglomerate.

6. A concrete mix according to any one of the preceding claims, in which the emulsion has been catalysed and accelerated.

7. A concrete mix according to claim 2, in which the volcanic granules comprise substantially 50% of granules having a size of 2 to 3 mms and substantially 50% of granules having a size of 3.5 to 4.5 mms.

8. A process for manufacturing concrete mix comprising immersing a selected amount of pozzolana granules in water, draining the granules, mixing the resulting moistened granules with alumina cement in a proportion of about 25% of the volume of pozzolana, forming an emulsion of a polyester resin by mixing the resin with about 50% by weight of water, the weight of resin being about 7% of the weight of the pozzolana granules, adding a catalyst and an accelerator to the emulsion, mixing the emulsion, and finally adding the emulsion to the mix-

ture of moistened pozzolana granules and alumina cement, the mixing being continued before draining excess water from the mixture to obtain the concrete mix.

9. A concrete mix according to claim 1 and substantially as herein described.

10. A concrete article formed from a mix according to claim 1 which has been allowed to harden.

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